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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/820,464	04/08/2004	Graeme Storm	02EDI46652637	7257

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EXAMINER	
QUIETT, CARRAMAH J	
ART UNIT	**PAPER NUMBER**
2622	

MAIL DATE	DELIVERY MODE
06/04/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/820,464	STORM ET AL.	
	Examiner	Art Unit	
	Carramah J. Quiett	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *04/08/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Europe on 05/06/2003. It is noted, however, that applicant has not filed a certified copy of the 03252835.8 application as required by 35 U.S.C. 119(b).

Claim Objections

2. **Claims 15-20** objected to because of the following informalities: The limitation, "*An* image sensor" appears in each of the objected claims, which are dependent claims. Please change that limitation to, "*The* image sensor". Appropriate correction is required. Appropriate correction is required.

3. **Claims 22-30** objected to because of the following informalities: The limitation, "*An* image sensor" appears in each of the objected claims, which are dependent claims. Please change that limitation to, "*The* image sensor". Appropriate correction is required. Appropriate correction is required.

4. **Claims 32-36** objected to because of the following informalities: The limitation, "*A* method" appears in each of the objected claims, which are dependent claims. Please change that limitation to, "*The* method". Appropriate correction is required. Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. **Claims 14-16, 21-26, and 31-33** are rejected under 35 U.S.C. 102(b) as being anticipated by Tu et al. ("CMOS Active Pixel Image Sensor with Combined Linear and Logarithmic Mode Operation"; Department of Electrical Engineering, University of Waterloo, On; 1998 IEEE Canadian Conference on Electrical and Computer Engineering; 24-28 May 1998; vol. 2; p. 754-757) – herein referred to as *Tu*.

For **claim 14**, Tu discloses an image sensor (fig. 1), comprising:

an array of pixels (p. 754, paragraphs 4-5), each pixel (fig. 2) comprising

a photodiode (p. 754, paragraph 5; fig. 2 a/b),

a first output circuit for deriving a linear output signal by applying a reset signal to said photodiode and reading a voltage on said photodiode after an integration time (p. 755, paragraph 3 – *Linear Integration mode*; fig. 2a), and

a second output circuit for deriving a logarithmic output signal by reading a near instantaneous illumination-dependent voltage on said photodiode that is a logarithmic function of the illumination (p. 755-756, paragraph 4 – *Logarithmic mode*, fig. 2b).

For **claim 15**, Tu discloses the image sensor according to claim 14, wherein said first output circuit (fig. 2 a) comprises:

a reset switch (pixel reset transistor) for applying a reset voltage to said photodiode, said reset switch comprising a reset transistor including a conducting terminal connected to said photodiode (p. 754, paragraph 5); and

a readout switch (source-follower amplifier) for turning on the conducting terminal of said reset transistor after expiration of the integration time (p. 754, paragraph 5; p. 755, paragraph 4).

For **claim 16**, Tu discloses the image sensor according to claim 14, wherein said second output circuit (fig. 2b) comprises:

an amplifier (source-follower amplifier; p. 754, paragraph 5); and

a log select switch for connecting said amplifier to said photodiode (p. 755, paragraph 4).

For **claim 21**, Tu discloses the image sensor (fig. 1) comprising:

an array of pixels (p. 754, paragraphs 4-5), each pixel (fig. 2)comprising

a photodiode (p. 754, paragraph 5; fig. 2 a/b),

a first output circuit connected to said photodiode for generating an output signal to be a linear output signal (p. 755, paragraph 3 – *Linear Integration mode*; fig. 2a), and

a second output circuit connected to said photodiode for generating the output signal to be a logarithmic output signal (p. 755-756, paragraph 4 – *Logarithmic mode*, fig. 2b).

For **claim 22**, Tu discloses the image sensor according to claim 21, wherein the linear output signal is selected if the pixel has not saturated during generation of the linear output signal, otherwise, the logarithmic output signal is selected (p. 755, paragraph 4; p. 756, paragraphs 1-4).

For **claim 23**, Tu discloses the image sensor according to claim 21, wherein said first output circuit derives the linear output signal by applying a reset signal to said photodiode and reading a voltage on said photodiode after an integration time (p. 755, paragraph 3 – *Linear Integration mode*; fig. 2a).

For **claim 24**, Tu discloses the image sensor according to claim 21, wherein said second output circuit derives a logarithmic output signal by reading a near instantaneous illumination-dependent voltage on the photodiode that is a logarithmic function of the illumination (p. 755, paragraph 4; p. 756, paragraphs 1-4).

Claims 25-26 are claims corresponding to the claims 15-16, respectively. Therefore, claims 25-26 are analyzed and rejected as previously discussed with respect to claims 15-16, respectively.

For **claim 31**, Tu teaches a method for operating an image sensor comprising an array of pixels (p. 754, paragraphs 4-5), each pixel comprising a photodiode (p. 754, paragraph 5; fig. 2 a/b), the method comprising:

deriving a linear output signal from each pixel (p. 755, paragraph 3 – *Linear Integration mode*; fig. 2a),;

deriving a logarithmic output signal from each pixel (p. 755-756, paragraph 4 – *Logarithmic mode*, fig. 2b); and

selecting the linear output signal if the pixel has not saturated during generation of the linear output signal, otherwise, selecting the logarithmic output signal (p. 755, paragraph 4; p. 756, paragraphs 1-4).

For **claim 32**, Tu teaches the method according to claim 31, wherein deriving the linear output signal from each pixel comprises:

applying a reset voltage to the photodiode (p. 754, paragraph 5);

allowing for a predetermined integration time (p. 755, paragraph 1); and

reading an output voltage on the photodiode (p. 754, paragraph 5; p. 755, paragraph 4).

For **claim 33**, Tu teaches the method according to claim 31, wherein deriving the logarithmic output signal is based upon reading a near instantaneous illumination-dependent voltage on the photodiode that is a logarithmic function of the illumination (p. 755, paragraph 4; p. 756, paragraphs 1-4).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. **Claims 17 and 27** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tu in view of Luo et al. (U.S. Pat. #7,071,982).

For **claim 17**, Tu discloses the image sensor according to claim 16, wherein said amplifier is connected to the conducting terminal of said reset transistor. However, Tu does not expressly disclose wherein said amplifier comprises a differential amplifier having an inverting input connected to the conducting terminal of said reset transistor, and a non-inverting input connected to a reference voltage.

In a similar field of endeavor, Luo discloses the image sensor (fig. 2), wherein said amplifier comprises a differential amplifier (36) having an inverting input connected to the conducting terminal of said reset transistor (V_{PH}), and a non-inverting input connected to a reference voltage (V_{REF}). Please read Luo, col. 5, lines 25-46. In light of the teaching of Luo, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the amplifier of Tu with a differential amplifier as claimed in claim 17 in order to

improve the image capture efficiency thereby providing an image with increased wide dynamic range as well as improving power consumption (Luo, col. 1, line 63 – col. 2, line 39).

Claim 27 is a claim corresponding to claim 17. Therefore, claim 27 is analyzed and rejected as previously discussed with respect to claim 17.

9. **Claims 18-19, 28-29, and 34-35** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tu in view of Kusaka et al. (US 2005/0052557) – herein referred to as Kusaka.

For **claim 18**, Tu discloses the image sensor according to claim 14. However, Tu does not expressly teach further comprising a calibration circuit for calibrating each pixel before deriving the logarithmic output signal.

In a similar field of endeavor, Kusaka discloses an image sensor (fig. 1, ref. 1) comprising a calibration circuit (fig. 1, refs. 4-6) for calibrating each pixel before deriving the logarithmic output signal (p. 3-4, paragraphs 54-71). Also, please see Kusaka, figs. 2-3. In light of the teaching of Kusaka, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the image sensor of Tu with a calibration circuit as claimed in claim 18 in order to automatically achieve an improved wide brightness range as well as an improved a narrow brightness range (p. 1, paragraphs 7-12).

For **claim 19**, Tu, as modified by Kusaka, discloses the image sensor according to claim 18, wherein said calibrating circuit comprises a constant current source selectively connected to each respective pixel (p. 3, paragraph 60; fig. 3).

Claims 28-29 are claims corresponding to the claims 18-19, respectively. Therefore, claims 28-29 are analyzed and rejected as previously discussed with respect to claims 18-19, respectively.

Claims 34-35 are claims corresponding to the claims 18-19, respectively. Therefore, claims 34-35 are analyzed and rejected as previously discussed with respect to claims 18-19, respectively.

10. **Claims 20, 30, and 36** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tu in view of Kusaka as applied to claims 19, 29 and 35 above, and further in view of He et al. (US 6,355,965) – herein referred to as He.

For **claim 20**, Tu, as modified by Kusaka (fig. 3) discloses the image sensor according to claim 19, wherein an output node (Kusaka fig. 3, the node between T1 and T2) is associated with each photodiode, and wherein the linear and logarithmic output signals are derived from the output node (Kusaka, p. 3-4, paragraphs 63-64). However, Tu, as modified by Kusaka, does not expressly disclose said calibration circuit further comprising a switch connected between said photodiode and the output node for isolating said photodiode from the output node while calibration takes place.

In a similar field of endeavor, He discloses a calibration circuit comprising a switch (fig. 4, S2) connected between said photodiode and the output node for isolating said photodiode from the output node while calibration takes place (col. 4, lines4-23). In light of the teaching of He, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the image sensor of Tu, as modified by Kusaka, with a switch as claimed in claim 20 in order to change to calibration mode (He, col. 4, lines4-23).

Both of **claims 30 and 36** are claims corresponding to the claim 20. Therefore, claims 30 and 36 are each analyzed and rejected as previously discussed with respect to claim 20.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Loose et al. ("A self-calibrating single-chip CMOS camera with logarithmic response"; IEEE Journal of Solid-State Circuits, Vol.36, Iss.4, Apr 2001; Pages: 586-596).	A self-calibrating single-chip CMOS camera with logarithmic response thereby reducing FPN.
Luo et al. (US 2003/0076432 A1)	A time domain sampling technique for a CMOS imager enabling wide dynamic range and flexibility utilizing integration time and a reference variable during sampling.
Böhm et al. (US 6,606,121 B1)	A local auto-adaptive optical sensor to avoid over/under exposure of pixels.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Carramah J. Quiett whose telephone number is (571) 272-7316. The examiner can normally be reached on 8:00-5:00 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, NgocYen Vu can be reached on (571) 272-7320. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CJQ
May 24, 2007

NGOC-YEN VU
SUPERVISORY PATENT EXAMINER